

TWIST AFTER DYEING METHOD OF PROCESSING YARN

Technical Field and Background of the Invention

[0001] This invention relates to a "twist after dyeing" process by which a process step is eliminated, resulting in a first quality yarn manufactured with less labor and machinery steps. As implied above, the twisting and dyeing steps are reversed from conventional yarn processes. The invention has particular application in the production of sewing thread, although other applications are possible, as well.

[0002] A typical prior art yarn processing method begins with partially-oriented yarn ("POY"), such as polyester. The POY is textured using a false-twist texturing operation, a well-known and widely-used process for imparting desired bulk to the yarn by drawing it and imparting a twist-induced crimp to the yarn. Alternatively, an air-jet texturing process can be used. The false twisted yarn is taken up on a package for further processing. From the false-twist operation the yarn is processed in a twisting operation, usually on a 2-for-1 twister, where actual twist is imparted to the yarn, typically in the range of 1 to 8 turns per inch. The yarn is taken up on the 2-for-1 twister onto a dyeing package. The dyeing packages of yarn are then placed in a dyeing vessel, for example, a pressure kier, and dyed using a combination of water, dye and other chemicals while subjected to heat and pressure for a predetermined period of time sufficient to evenly dye all of the yarn on all of the packages to the proper depth of shade.

[0003] After dyeing the yarn is dried by either subjecting the yarn to heat or extracting the moisture, for example, in a centrifuge or a combination of both. Finally, the yarn is wound off of the dyeing package onto an end use package such as a paper or plastic tube or cone. During this process an appropriate finish such as a lubricant can be applied if required by the anticipated end use. At this point the package is ready for

shipment to the customer for use, typically for knitting or weaving fabrics, or for use as sewing thread.

[0004] As is apparent from the foregoing, three package change steps are required: (1) POY package to the false twist package; (2) false-twist package to the dyeing package; and (3) dyeing package to the end use package.

[0005] The present invention is directed to a process by which the same yarn can be produced using only two package change steps, from the POY package to a dye package, and from the dye package to the end use package, while nevertheless producing a yarn equal or superior to an equivalent yarn produced according to prior art processes.

Summary of the Invention

[0006] Therefore, it is an object of the invention to provide a yarn processing method which produces a yarn with fewer process steps.

[0007] It is another object of the invention to provide a yarn processing method which reduces the number of package changes required during a process of producing a dyed yarn.

[0008] It is another object of the invention to provide a yarn processing method which permits a yarn to be dyed before final twist is added to the yarn.

[0009] These and other objects of the present invention are achieved in the preferred embodiments disclosed below by providing a method of processing yarn, comprising the steps of texturing a partially-oriented yarn to provide the yarn with a predetermined denier and elongation while imparting desired bulk and shrinkage characteristics and applying the textured yarn onto a dye package, and placing the dye package with the textured yarn thereon in a dyeing vessel and dyeing the yarn with a combination of pressure, heat and chemicals to impart a desired color to the yarn. The yarn is dyed, the dyed yarn removed from the dye package and a twist applied to the dyed

yarn. The twisted yarn is taken up onto an end use package, and the twist in the yarn is set.

[0010] According to one preferred embodiment of the invention, the steps of removing the dyed yarn from the dye package, applying a twist to the dyed yarn, and taking up the twisted yarn onto an end use package are carried out in a single continuous process step.

[0011] According to another preferred embodiment of the invention, the yarn is dried using heat.

[0012] According to yet another preferred embodiment of the invention, the yarn is dried using moisture extraction.

[0013] According to yet another preferred embodiment of the invention, the step of texturing the yarn comprises the step of false-twist texturing the yarn.

[0014] According to yet another preferred embodiment of the invention, the step of twisting the yarn comprises the step of twisting the yarn on a 2-for-1 twister.

[0015] According to yet another preferred embodiment of the invention, the twist applied to the yarn by the 2-for-1 twister is between 1 and 8 twists per inch.

[0016] According to yet another preferred embodiment of the invention, the end use package comprises a cone.

[0017] According to yet another preferred embodiment of the invention, the processed yarn comprises sewing thread.

[0018] According to yet another preferred embodiment of the invention, a method of processing yarn to produce a sewing thread, comprises the steps of false-twist texturing a partially-oriented yarn to provide the yarn with a predetermined denier and elongation while imparting desired bulk and shrinkage characteristics suitable for sewing thread and applying the false-twisted yarn onto a dye package and placing the dye package with the false-twisted yarn thereon in a dyeing vessel and dyeing the yarn with a combination of

pressure, heat and chemicals to impart a desired color to the yarn. The dyed yarn is dried and then removed from the dye package. A sewing thread level of twist is applied to the dyed yarn and the twisted yarn is taken up onto an end use package. The twist in the yarn is thereafter set.

[0019] According to yet another preferred embodiment of the invention, the steps of removing the dyed yarn from the dye package, applying a twist to the dyed yarn, and taking up the twisted yarn onto an end use package are carried out in a single continuous process step.

[0020] According to yet another preferred embodiment of the invention, the yarn is dried using heat.

[0021] According to yet another preferred embodiment of the invention, the yarn is dried using moisture extraction.

[0022] According to yet another preferred embodiment of the invention, the yarn is dried using a combination of both moisture extraction and heat.

[0023] A method of processing yarn according to claim 10 or 11, wherein the step of twisting the yarn comprises the step of twisting the yarn on a 2-for-1 twister.

[0024] According to yet another preferred embodiment of the invention, the twist applied to the yarn by the 2-for-1 twister is between 1 and 8 twists per inch.

[0025] According to yet another preferred embodiment of the invention, the end use package comprises a cone.

[0026] Yarns produced according to the processes disclosed are also disclosed.

Brief Description of the Drawings

[0027] Some of the objects of the invention have been set forth above. Other objects and advantages of the invention will appear as the description proceeds when taken in conjunction with the following drawings, in which:

[0028] Figure 1 is a flow diagram of a prior art method of producing yarn wherein the yarn is twisted before dyeing; and

[0029] Figure 2 is a flow diagram of a method of producing yarn wherein the yarn is dyed before twisting.

Description of the Preferred Embodiment and Best Mode

[0030] Referring now specifically to the drawings, a prior art method of producing yarn is illustrated in the flow diagram of Figure 1. The POY 10 is textured using either a false-twist or air-jet texturing operation 11, both well-known and widely-used processes for imparting desired bulk to the yarn 10 by drawing it and imparting a crimp to the yarn 10. The false twisted or air-jet textured yarn 10 is taken up on a package for further processing. From the texturing operation the yarn 10 is processed in a twisting operation 12, usually on a 2-for-1 twister, where actual twist is imparted to the yarn 10, typically in the range of 1 to 8 turns per inch. The yarn 10 is taken up on the 2-for-1 twister onto a dyeing package. The dyeing packages of yarn 10 are then placed in a dyeing vessel, for example, a pressure kier, and dyed in a dyeing process 13 using a combination of water, dye and other chemicals while subjected to heat and pressure for a predetermined period of time sufficient to evenly dye all of the yarn 10 on all of the packages to the proper depth of shade.

[0031] After dyeing the yarn 10 is dried in a drying process 14 by either subjecting the yarn 10 to heat or extracting the moisture, for example, in a centrifuge or a combination of both. Finally, the yarn 10 is wound off of the dyeing package in a winding process 15 onto an end use package such as a paper or plastic tube or cone. During this process an appropriate finish such as a lubricant can be applied if required by the anticipated end use. At this point the package is ready for shipment to the customer for use, typically for knitting or weaving fabrics, or for use as sewing thread.

[0032] Thus three package change steps are required in this prior art method: (1) POY package to the false twist package at process step 11; (2) false-twist package to the dyeing package at process step 12; and (3) dyeing package to the end use package at the final winding process step 15.

[0033] Referring now to Figure 2, a flow diagram of the novel dyeing process is illustrated. The POY 20 is textured using either a false-twist or air-jet texturing operation 21, where the desired bulk is imparted to the yarn by drawing it and imparting a crimp. The false twisted or air-jet textured yarn 20 is taken up by the false-twist or air-jet machine onto a dye package for dyeing.

[0034] The yarn 20 is then dyed in a conventional dye operation 22 such as in a pressure kier using a combination of water, dye and other chemicals while subjecting the yarn 20 to heat and pressure for a predetermined period of time sufficient to evenly dye all of the yarn 20 on all of the packages to the proper depth of shade.

[0035] The yarn 20 is then dried in a drying process 23 using heat, moisture extraction or a combination of both. The dried yarn 20, still on the dye package, is delivered to a twisting operation 24 where actual twist is applied. This may be done on a 2-for-1 twister such as a ICBT Model DT 350EH 2-for-1 twister. The twisted yarn 20 is delivered to a take-up where it is wound onto an end use package such as a conventional paper or plastic tube or cone. During the delivery to the take-up location a finish such as a lubricating oil may be applied to the surface of the yarn 20.

[0036] After the twisting operation is complete, the yarn 20 possesses torque in the direction opposite the twist whereby the yarn tends to resume its untwisted state. This torque is eliminated by autoclaving the yarn 20 on the end use package in an autoclave 25. The autoclave exposes the yarn 20 to high heat for a specified period of time necessary to set the twist level permanently and relax the yarn in its twisted state. At this point the process is complete and the yarn 20 is ready for delivery to the customer for use.

[0037] As described above it can be seen that the novel process enables the yarn 20 to be produced using only two package change steps, from the POY package to a dye package at the texturing process 21, and from the dye package to the end use package at the twisting process 24, while nevertheless producing a yarn equal or superior to an equivalent yarn produced according to prior art processes.

[0038] Examples of yarn produced using the novel process are set out below:

Example 1

Dry Denier	170	+/- 10%
Strength	740	+/- 10%
Elongation	28%	+/- 10%
Shrinkage	<2%	

Example 2

Dry Denier	220	+/- 10%
Strength	925	+/- 10%
Elongation	27%	+/- 10%
Shrinkage	<2%	